

WHAT IS CLAIMED IS:

1. A method comprising:

(a) providing a substrate having at least one recessed feature characterized by a width of less than about 0.3 microns and an aspect ratio of 5 or higher,

(b) coating onto the substrate a composition comprising (i) a curable polymeric material, (ii) a thermally deactivatable gap-filling aid, and (iii) at least one solvent,

(c) drying the coated substrate to remove the solvent, leaving a composition of curable polymeric material and gap-filling aid substantially filling the recessed feature,

(d) heating the coated substrate to cure the polymeric material and to de-activate the gap-filling aid.

2. The method of claim 1 wherein the cured polymeric material has a glass transition temperature of at least 300°C.

3. The method of claim 1 wherein the cured polymeric material has a glass transition temperature of at least 350°C.

4. The method of claim 1 wherein the cured polymeric material has a glass transition temperature of at least 400°C.

5. The method of claim 1 wherein the cured polymeric material has a thermal stability temperature of at least 350°C.

6. The method of claim 1 wherein the aspect ratio is 10 or higher.

7. The method of claim 1 wherein the gap width is 0.2 microns or less.

8. The method of claim 1 wherein the gap-filling aid is reactive with the curable polymer.
9. The method of claim 1 wherein the gap-filling aid volatilizes and diffuses out of the curable polymer when the composition is heated.
10. The method of claim 1 wherein the gap-filling aid decomposes and the decomposition products diffuse out of the curable polymer when the composition is heated.
11. The method of any of the preceding claims wherein the curable polymer is organic.
12. The method of claim 11 wherein the organic polymer is a polyimide.
13. The method of claim 11 wherein the organic polymer is a polyarylene or polyarylene ether.
14. The method of claim 11 or claim 13 wherein the polymer has a number average molecular weight in the range of 3,000 to 10,000.
15. The method of claim 13 or 14 wherein the polymer comprises diene reactive groups, dienophile reactive groups, or both.
16. The method of claim 15 wherein the gap filling aid is a reactive monomer or reactive low molecular weight oligomer having reactive groups selected from dienes, dienophiles, and combinations thereof.

17. The method of claim 15 or 16 wherein the reactive functional groups are cyclopentadienone and acetylene groups.
18. The method of claim 17 wherein the reactive monomer comprises acetylene functional groups.
19. The method of any one of claims 1 through 11 wherein the gap filling aid is selected from reactive monomers; reactive, low molecular weight oligomers; and low molecular weight thermally transient modifiers.
20. The method of claim 19 wherein the thermally transient modifier is a polystyrene, polyacrylate, or polymethacrylate.
21. The method of any one of the preceding claims wherein the curable polymer is present in amounts of 5-40% by weight of the composition and the gap filling aid is present in an amount of 1-20% by weight of the composition.
22. The method of claim 21 wherein the curable polymer is present in an amount of 10-30% by weight of the composition, and the gap filling aid is present in an amount of 3-15% by weight of the composition.
23. The method of claim 18 wherein the reactive monomer is a tris(phenylethynyl) benzene.
24. An article made by the method of any one of claims 1-23.
25. A composition comprising (i) a curable polymeric material, (ii) a thermally deactivatable gap-filling aid, and (iii) at least one solvent.